Assessment and Management of Hypercalcaemia in the Emergency Department

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Calcium physiology

Calcium is an important cation involved in membrane transport, bone metabolism and cellular transport. The majority of calcium in the body is within intracellular compartments and bone, with only 1% present in the extracellular fluid. Half the circulating calcium in the body is bound to proteins, such as albumin and the other half is ionised.

The levels of calcium in the body are governed by parathyroid hormone (PTH), which is released by the parathyroid glands when calcium levels appear low. PTH acts to increase calcium levels by stimulating osteoclast activity in bone, enhancing vitamin D metabolism in the kidney and increasing phosphate excretion in the kidney.

The normal range for serum calcium is 2.1-2.6mmol/L. Hypercalcaemia is defined as serum calcium >2.6mmol/L. Patients with serum calcium >3.5mmol/L would be considered to be in a hypercalcaemic crisis, and are at risk of arrythmia and coma.

Causes of hypercalcaemia

The vast majority of patients with hypercalcaemia have either primary hyperparathyroidism or an underlying malignancy. There are other rare causes of hypercalcaemia such as sarcoidosis, milka-alkali syndrome, Paget's disease, vitamin D excess and familial hypocalciuric hypercalcaemia. Iatrogenic causes of hypercalcaemia are use of thaizide diuretics and lithium.

Clinical signs of hypercalcaemia

- Renal stones
- Polyuria
- Polydypsia
- Lethargy
- Confusion
- Depression
- Constipation
- Abdominal pain
- Nausea and vomiting
- Irritability
- Bone pain
- Osteoporosis
- Short QT and Osborn/J waves on ECG
- Arrhythmia

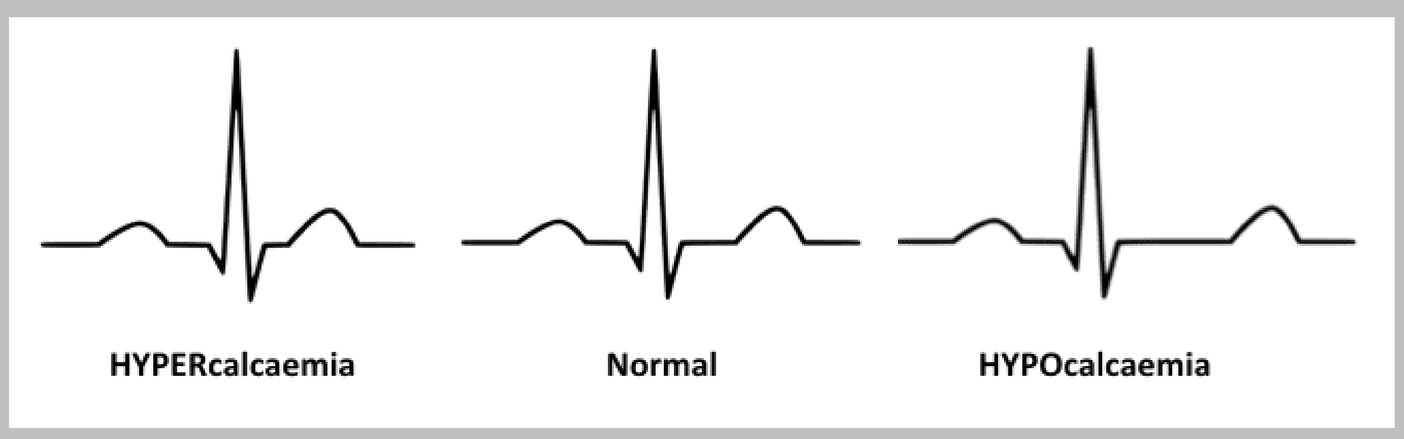

Figure 1: ECG changes associated with changes in serum calcium level

Treatment of hypercalcaemia

Patients who have symptomatic hypercalcaemia or have an adjusted calcium >3mmol/L should be started on treatment. The mainstay of treatment for hypercalcaemia is with fluids and bisphosphonates. Patients should be hydrated with normal saline for 12-24 hours and then if they are still hypercalcaemic, started on IV disodium pamidronate in 500ml of NaCl 0.9% at a rate of 1mg/min. The recommended total dose of bisphosphonate is based on the serum calcium level.

Calcium Level (mmol/L)	Recommended total dose (mg)
Up to 3.0	15-30
3.0-4.0	30-60
3.5-4.0	60-90
>4.0	90

Table 1: dose of disodium pamidronate used to treat hypercalcaemia

References

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